WILEY CLINICAL ORAL IMPLANTS RESEARCH

Mesenchymal stem cells and hyaluronic acid for bone grafting

Eduardo Teixeira[1]; Daniel Boeckel[1]; Patricia Sesterheim[2]; Roberta Fulginiti[1]; Rosemay Shinkai[1]; Denise Machado[3]

[1]*PUCRS – Odontologia, Brazil;* [2]*FEEPS – POA, Brazil;* [3]*PUCRS – Medicina, Brazil*

Background: Tissue engineering has been considered a promising method for bone tissue regeneration in Dentistry. Its main objective is to regenerate lost tissues overcoming problems usually seen in conventional grafting, such as the risk of pathogen transmission and therefore cross-linked infections, undesired immunologic reactions, morbidity at tissue donor sites and poor regenerative capacity of some conventional biomaterial

Aim/Hypothesis: This study investigates the applicability of mesenchymal stem cells and hyaluronic acid as a graft compound for bone tissue engineering, combining a specific HA scaffold in the form of a hydrogel with in vitro-induced multipotent adipose-derived stromal cells (mADSCs).

Material and Methods: First, an in vitro evaluation of cell viability was conducted applying an MTT (methyltetrazolium) assay of mADSCs cultured with HA at acid concentrations of 100%, 75%, 50%, 25% and 15% for 24, 48 and 72 hours. The results demonstrated the cell viability of the HA and mADSCs above 60% at all time points and concentrations tested. Then, a critical bone defect of 2 mm in diameter was created on each femur of 25 adult male rats in vivo, and the following five grafting treatments were then performed- I Control – defect only (C)+ II – HA only+ III – mADSCs alone+ IV – mADSCs+HA+ and V – mADSCs previously osteoinduced+HA. After 23 days, the implanted region was evaluated using microcomputed tomography (micro-CT), histomorphometry and RT-PCR (real-time reverse transcriptase-polymerase chain reaction) analysis.

Results: Micro-CT analysis indicated that group IV had significantly higher means of bone contact surface (BDS) and bone density surface (BDS) (102 mm^2 and 17%, respectively) than the groups I (63 mm^2 and 10%, respectively) and II (62 mm^2 and 11%, respectively) ($P < 0.05$), suggesting a better performance for grafts presenting cells in their composition. The histomorphometric findings corroborated these Micro-CT analysis results, also showing higher means of bone regeneration areas in group IV compared to groups I and II ($P < 0.05$). The RT-PCR ratios showed no difference for type 1 collagen (Col1A) and osteopontin (OP) genes expression among the analyzed groups, whereas for the osteonectin (ON) gene expression, significantly higher means where verified for groups II and V ($P < 0.05$).

Conclusions and Clinical Implications: The results presented here suggest that a combination of HA and mADSCs may offer a promising alternative for bone tissue augmentation. The use of undifferentiated mADSCs might improve the obtained results of these bone grafts, as they require less cell manipulation and thus might lead to a safer, faster and maybe better grafting procedure in terms of preparation time, biological safety and cost effectiveness.